

the disc; this phantom wheel appears motionless if the periods exactly coincide, but if they do not, it slowly revolves in one direction or the other. It is obvious that this affords an easy method of counting the vibrations of the flame. With a sixteen inch tube I thus found the number of complete vibrations per second to be about 453.

When the disc is rotated in front of a vertical vibrating wire, the eye being placed where the slits pass in a horizontal position, the interval of the slits passing being equal to a complete vibration of the wire, the wire appears thrown into undulations and motionless. If the periods do not exactly coincide, the undulations travel up or down the wire. If the velocity of the disc be doubled, or trebled, the apparent number of wires is increased in like proportion; and if it be regarded by the two eyes placed where the slits do not pass in a horizontal position, they assume the form of spirals, which appear to revolve around each other in an extremely beautiful and illusive manner. In the above cases I have supposed the wire to be twanged in the centre, in which case the undulations are beautifully symmetrical curves, and represent a pure note. If, however, the wire be twanged near to one end, the change in the *quality* of the note is manifest, the irregularity of the curves showing the presence of minor undulations superimposed upon the primary one. The best wire for this purpose is a fine spiral one, as it gives vibrations of great amplitude, and of long continuance. A vibrating steel rod also appears thrown into the same undulations.

CHARLES J. WATSON

THE ACTION OF FLUORSPAR ON DIFFERENT QUALITIES OF CAST IRON

IN my articles contributed to NATURE (No. 57, p. 94, and No. 64, p. 233), I have given descriptions of my process of applying fluorspar combined with oxides, and fluorspar combined with oxides containing titanium, to ordinary cast iron.

It is reported that attempts have been made to apply fluorspar alone to ordinary cast iron by eminent chemists in the laboratory, but the results have been of a negative character. These reports have been corroborated by my own experiments. I have discovered,* however, that although fluorspar has no effect when used alone in treating ordinary cast iron, it will act energetically upon cast iron containing titanium. The titaniferous cast iron was made at Glassdale Furnaces, near Whitby, by melting Cleveland white pig iron in a cupola in admixture with Norwegian titanic iron ore, and blast furnace cinder as a flux. This metal was treated here in the laboratory by being melted upon powdered fluorspar. The resulting metal was found to be wrought iron.

These results may be obtained in any suitable vessel, furnace, apparatus, or process; the only conditions necessary to be observed are, that the metal be maintained in the fluid state, and the fluorspar placed so as to act upon the metal from the under side upwards, or placed in admixture with it, and that when apparatus is used having silicious linings, the silicious linings be protected with sheet or cast iron placed upon the silicious lining before the fluorspar and iron to be treated are charged into the vessels. No labour is necessary, except that of "bailing" the metal, and removing it from the apparatus.

The results given by this experiment go to prove that by this process superior qualities of wrought iron, which will be purer than the highest standard brands of wrought iron, may be produced from the English Cleveland pig iron, which contains, according to the best metallurgical authorities, from 1.25 to 1.38 per cent. of phosphorus.

One ton of Cleveland pig iron was melted in a cupola with 7 cwt. of Norwegian titanic iron ore, containing, by analysis, about 40 per cent. of titanic acid. The resulting metal was titaniferous cast iron, analysing:—

Titanium	1.2551
Silicon	1.8139
Phosphorus	0.4604
Sulphur	0.3620
Carbon	1.2982

* Patent No. 318, Feb. 3, 1870

Hence it appears that the iron, by being re-melted with titaniferous iron ore, took up 1.25 per cent. of titanium, and lost 0.90 per cent. of phosphorus, and 1.75 per cent. of carbon. It is obvious that the metal in this condition is not available for any purpose without subsequent treatment, as it contains about as great an amount of impurities as it did before treatment.

The advantages gained by re-melting the pig iron with titaniferous iron ore are, a reduction of the amount of phosphorus and carbon, and the alloying of the metal with titanium, which facilitates the removal of the impurities in the subsequent treatment.

The above described titaniferous cast iron was remelted upon fluorspar, and about 30 minutes after the iron melted, or in about an hour after they were both charged, the iron was found to be malleable iron; the button analysing as follows:—

Titanium	0.0215
Silicon	None
Phosphorus	0.1399
Sulphur	0.0620
Carbon	Traces

When worked on a larger scale, so as to produce blooms that can be worked into merchantable shapes, the finished results will show less phosphorus and sulphur than the above analysis, as it is well known to metallurgists, by the experiments of Messrs. Calvert and Johnson, published in full in Kerl's "Metallurgy," vol. ii., "Copper and Iron," 1869, that 0.022 per cent. of phosphorus, and 0.040 per cent. of sulphur, are removed in working blooms into finished iron.

It will be seen that the action of the fluorspar removed 4.9662 per cent. of the impurities contained; and that the resulting metal contains less impurities in amount than the highest standard qualities of wrought iron. The explanation of these effects I leave to chemical investigators, without hazarding an opinion which might be erroneous, and therefore disadvantageous to me.

JAMES HENDERSON

MR. WALLACE'S ANNIVERSARY ADDRESS*

A CONSIDERABLE portion of this Address is devoted to a discussion of the facts of distribution of beetles, as presented by Mr. Wollaston in his great work, the "Insecta Maderensia," with special reference to the views advocated by Mr. Andrew Murray, in his paper on the Geographical Distribution of Beetles. After touching on the various methods by which insects are known to be distributed, and mentioning several of the instances in which they have been captured some hundreds of miles from land, it is concluded that, in opposition to the view held by Mr. Murray, there is no reason to believe that the Atlantic islands owe their Coleoptera to a former land connection with the continent, more especially as there is such strong evidence against that view in the total absence of mammals and reptiles. Mr. Wallace then applies Mr. Wollaston's facts to a detailed test of these views; and, as this portion of the paper is of general interest to naturalists, we give it at length:—

The most novel and striking facts brought out by Mr. Wollaston's researches in Madeira are, as is well known (1) the affinity with the Mediterranean fauna; (2) the total absence of certain large divisions of Coleoptera abundant in that fauna; (3) the number of new and peculiar species and of new and anomalous genera; and (4) the unexampled preponderance of apterous species. Now accepting, as Mr. Murray does, the theory of slow change of forms by natural causes, we may take the first and third of these facts as proving that the origin of the Madeiran fauna is of very ancient date. Let us see, therefore, how the second and the fourth set of facts bear upon the mode of its origin, whether by a land-connection with Europe or by transmission across the sea. It will be convenient to take first the facts presented by the apterous or winged condition of the species.

This striking peculiarity consists, either in species being apterous in Madeira which are winged elsewhere, or in genera which are usually winged consisting of only apterous species in Madeira, or lastly, in the presence of endemic apterous genera, some of which have winged allies, while others belong to groups

* An Address read at the Anniversary Meeting of the Entomological Society of London, on the 23rd of January, 1871, by Alfred R. Wallace, F.Z.S., F.R.G.S., President.

which are wholly apterous. Such phenomena undoubtedly show that there is something in Madeira which tends to abort wings; and Mr. Wollaston was himself the first to suggest that it was connected with exposure to a stormy atmosphere. His further observation, that many of the winged species had wings more developed than usual, enabled Mr. Darwin to hit upon that beautiful explanation of the facts which commends itself to all who believe in the theory of Natural Selection, while Mr. Wollaston himself admits it as fully accounting, teleologically, for the phenomena. That explanation briefly is, that the act of flying exposes insects to be blown out to sea and destroyed; those which flew least therefore lived longest, and by this process the race became apterous. With species to whom flight was a necessity, on the other hand, the strongest-winged lived longest, and thus their wings became more and more developed in each succeeding generation.

Now this view of the case enables us at once to explain some of the most striking gaps in the Madeiran coleopterous fauna. The Cicindelidæ, for instance, are entirely absent; and almost all the European species are winged insects of somewhat feeble flight, yet to whom flight is necessary. We can readily understand that such insects would be easily exterminated if they arrived singly or in small numbers; though it is not so easy to understand why, in a forest-clad island, some of the sylvan species should not have found a home had the land ever been connected with a continent where they abound. Their total absence is, therefore, decidedly unfavourable to the theory of a land-connection with Europe. To the Melolonthidæ and Cetoniidæ, as well as the Eumolpidæ and Galerucidæ, which are all wanting, the same argument will apply; and also to the Elateridæ and Buprestidæ, which are represented each by one minute species. But if Madeira is the remains of a continent once continuous with the south of Europe and deriving its fauna from such continuity, how are we to explain the absence of extensive genera very abundant in South Europe, and, from their being apterous, specially adapted to the peculiarities of Madeira? Such are *Carabus*, *Lamproyris*, *Pimelia*, *Akis*, and many others. But these facts are all consistent with the theory of introduction across the sea. Apterous groups, however abundant on the continent, should, as a rule, be absent; and I find that almost all the European apterous genera are wanting, and among the few exceptions there are some whose presence is easily explained and really prove the rule. We must remember, however, that the apterous condition, except in those cases where it is characteristic of an extensive group, is one of little stability or importance. There are species which are sometimes apterous and sometimes winged, and we may therefore be sure, that if any advantage was to be derived by either condition over the other, Natural Selection would very rapidly render it constant by the repeated survival of the favoured individuals. This is illustrated by the fact that we have winged and apterous species in the same genus, as well as winged and apterous genera in the same family. The coleopterous order being essentially winged, and the vast majority of its members being capable of flight, it is a presumption, if not almost a certainty, that all apterous varieties, species, or groups, have been derived from winged ancestors—comparatively recently in the case of the former, and at a more remote epoch as the character becomes more constant and attached to groups of higher classificational value.

Taking these principles as our guide, let us examine more closely the facts presented by the Madeiran Coleoptera, and their bearing on the rival theories as to their mode of introduction.

There are a large number of European beetles belonging to the very varied genera and families which are apterous, and a large proportion of these inhabit the south of Europe and North Africa. Now, on the theory of land connection, there should be no marked absence of these groups; on the contrary, apterous forms being especially adapted to Madeira, we should expect them to predominate. But, on the opposing theory of transmission across the sea, we should expect them to be wholly absent, or, if there are any exceptions, we should expect to be able to detect some special circumstances which might favour their transmission. A careful examination of Lacordaire's "Genera," and of some works on European Coleoptera, has furnished me with the following list of genera which are wholly apterous, and which abound in South Europe and North Africa.

Carabus possesses about eighty species in these regions; but is wholly absent from Madeira.

Thorictus has ten South European species, and one representative in Madeira, which is an ants'-nest species.

Rhizotrogus (Melolonthidæ), twenty-seven species in Sicily and Algeria, the very country to which the Madeiran fauna is traced, yet it is wholly absent.

Lamproyris, *Drilus*, and *Troglops* (Malacoderms), of which the females are apterous, possess twenty-seven South European and North African species; none in Madeira.

Oliorhynchus, *Brachycerus*, and twenty other genera of Curculionidæ, comprising more than 300 South European and North African species, are absent from Madeira, with two exceptions. One is the *Trachypylæus scaber*, a widely-spread European insect often found in ants' nests; and this, with the case of the *Thorictus*, renders it probable that ants'-nest species have some unusual means of distribution, which are by no means difficult to conceive. The other exception is that of the genus *Acalles*, which has a number of Madeiran species, all peculiar, and is very abundant in all the Atlantic islands. Now we have first to remark that *Acalles* is an isolated form, but is allied to *Cryptorhynchus*, which is often amply winged; so that we may easily suppose that its introduction to Madeira took place before it became completely apterous in Europe. In the second place we have the fact, that many of the species are confined to peculiar herbaceous and shrubby plants, in the stems of which they undergo their transformations, and which habit would afford facilities for their occasional transmission in the egg or pupa state across a considerable width of ocean, while a fragment of dry stem containing egg or larva might possibly be carried some hundred miles or more by a hurricane. Such suppositions would not be admissible to account for numerous cases of transmission, but, as will be seen, this is almost the only example of a genus of large-sized apterous European beetles occurring in Madeira.

Pimelia, *Tentyria*, *Blaps*, and eighteen other genera of Heteromera, comprising about 550 species of South Europe and North Africa, are totally absent from Madeira, with the following interesting exceptions:—two common species of *Blaps*, which are admitted to have been introduced by human agency, and three species of *Meloe*, two of which are European and one peculiar. The means by which the apterous, sluggish, and bulky *Meloes* were introduced is sufficiently clear, when we remember that the minute active larvæ attach themselves to bees, insects of exceedingly powerful flight, and more likely than perhaps any other to pass safely across 300 miles of ocean. That the solitary exception to the absence of wholly apterous genera of European Heteromera from Madeira should be the genus *Meloe*, is, therefore, one of those critical facts which almost demonstrate that it is not to land-continuity with the continent that the island owes its insect fauna.

Timarcha.—This, the only important apterous genus of Chrysomelidæ, is especially abundant in Spain and Algeria, and possesses forty-four South European and North African species; yet it is unknown in Madeira.

The occurrence of two isolated European species of characteristic Atlantic apterous genera—*Tarphius* and *Hegeter*—may seem to favour the opposite theory. The *Tarphius gibbulus* occurs in Sicily, and is the only European species of the genus, of which about forty inhabit the Atlantic islands. It is most nearly allied to the smallest of the Madeiran species, *T. Lowei*, which is abundant among lichen on weather-beaten rocks, and even ascends in the forest regions to the highest branches of the trees. These habits, with its minute size, are all in favour of this species, or some ancestral allied form, having been carried across by the winds or waves, thus transferring to Europe one of the peculiar types elaborated in the Atlantic isles. The *Hegeter tristis* is an analogous case, this species of an otherwise exclusively Atlantic genus having occurred on the opposite coast of Africa. These instances will furnish a reply to one of Mr. Murray's difficulties,—that all the migration has been in one direction, from Europe to Madeira, never from Madeira to the continent,—a difficulty, it may be remarked, which is wholly founded on an unproved and unprovable assumption; for how can it be determined that, in the case of *Acalles* for example, the genus had not been first developed in the Atlantic islands and then transferred to Europe, instead of the reverse? It is always assumed to have been the other way, but I am not aware that any proof can be obtained that it was so, and it is inadmissible to take this unproved assumption, and base an argument upon it as if it were an established fact.

We will next consider the facts presented by the distribution of those species of Coleoptera which range from Madeira to Europe, or to any of the other Atlantic islands. If their distri-

bution has been effected by land-continuity, we should expect that the proportion of winged and apterous species that extend their range beyond the island, should not be very strikingly different from the proportion that is found on the island. We do not find, for example, that the proportion of the wingless *Carabi* that have reached our own country from the continent by former land connection, is very different from that of the winged *Cicindela*.

Now, leaving out altogether those species which have certainly been introduced by man, and grouping the remainder for convenience in six divisions, we find that the Madeiran Coleoptera, which are not peculiar to it, may be classed as follows:—

31 species of Carabidæ, of which 26 are winged, 5 apterous.

The whole fauna, however, presents the very different proportion of 38 winged, 43 apterous.

93 species of the families from the Hydradeptera to the Tomicidæ inclusive, of which 90 are winged, 3 apterous. Total fauna: 220 winged, 27 apterous.

28 species of Curculionidæ, of which 26 are winged, 2 apterous. Total fauna: 35 winged, 74 apterous.

15 species of Longicornia and Phytophaga, of which 15 are winged, none apterous. Total fauna: 48 winged, 1 apterous.

20 species of Heteromera, of which 16 are winged, 4 apterous. Total fauna: 28 winged, 27 apterous.

76 species of Staphylinidæ, of which all are winged, none apterous. Total fauna: 109 winged, 6 apterous.

The totals are, for the wide-ranging species, 249 winged, 14 apterous = 263; for the whole fauna, 478 winged, 178 apterous = 656.

It thus appears that, in every case, an immensely smaller proportion of apterous than of winged species are widely distributed. If we take the totals, we find that while about two-fifths of the whole number of species range to other countries, only about one-thirteenth of the apterous species do the same, although among the strictly endemic species there are 160 apterous to only 110 winged! We can hardly impute such a constant and overwhelming preponderance to the fact that apterous insects have less facilities for extending their range, when we know that nearly every apterous genus possesses species of almost universal European distribution. I may here recall the fact, that of the above-mentioned fourteen apterous species which range out of Madeira, two are Meloe and two ants'-nest beetles, whose presence we have already sufficiently accounted for. It may no doubt be said that much of the difference here shown is due to the fact that the peculiar Madeiran species have had time to become apterous, while the species common to other countries have not yet had time to lose their wings; but this argument, although a valid explanation of some portion of the facts, if we admit that many of the latter have been recently introduced by natural causes, cannot be used by those who maintain a former land-connection as the sole origin of the fauna; for on that theory all the species now inhabiting the island (and not introduced by man) must date back to the same remote period, and have had equal time in which to be modified.

Let us now consider what are the special relations of the apterous Madeiran species as throwing light upon their possible or probable mode of introduction.

We have three species which Mr. Wollaston himself states to be usually winged elsewhere, but which are apterous in Madeira. These are *Metabletus obscuroguttatus*, *Calathus fuscus*, and *Bradycellus fulvus*. I am inclined to believe that there are a few others which will come under this category, but it is very difficult to get information as to the winged or apterous character of particular species. These insects, however, have evidently become apterous since their introduction into Madeira. We have therefore no difficulty in accounting for their introduction, and, as no other change in their external characters has been effected, we may suppose it to have been comparatively recent.

Next we have those genera which, though apterous in Madeira, are wholly or partially winged elsewhere. These comprise a large number of species, and are twenty-two in number, as follows:—Carabidæ: *Cymindis*, *Dromius*, *Metabletus*, *Scarites*, *Apolomus*, *Loricera*, *Leistus*, *Calathus*, *Olisthopus*, *Argutor*, *Cratognathus*, *Bradycellus*, *Trechus*. Philhyridæ: *Hydrobius*. Byrrhidæ: *Syncaelypta*. Curculionidæ: *Phleophagus*, *Tychius*, *Smicronyx*. Heteromera: *Phaleria*, *Helops*. Staphylinidæ: *Homalota* (1 sp.), *Othius*. Here we are carried back to a remoter epoch for the introduction of the winged ancestors of the Madeiran species, since not only have the wings become aborted, but the insects

themselves have become modified into distinct and often very well marked species.

The next category consists of apterous genera which are peculiar to Madeira and the other Atlantic islands, but which are allied to winged groups, as follows:—

Elliptosoma.—Closely allied to *Loricera*, winged.

Eurygnathus.—An abnormal form of *Licinides*, most of which are winged.

Zargus.—An abnormal form of *Chlænides*, winged.

Thalassophilus.—Allied to *Trechus*, winged.

Tarphius.—Belonging to the *Colydiidæ*, most of which, Mr. Pascoe informs me, have wings.

Coptostethus.—Allied to *Cryptohypnus*, winged.

Caulophilus.—Allied to *Phleophagus*, winged.

Lipommata, *Mesoxenus*, *Caulotropis*.—Anomalous genera of *Cossonides*, which are often winged.

Acalles, *Torneuma*.—Aberrant genera of *Cryptorhynchides*, most of which are winged.

Echinosoma.—Doubtful affinities.

Atlantis, *Cyphoscelis*, *Laparocerus* (*Laparocerides*).—A very isolated group.

Anenophilus, *Scoliocerus*.—Allied to *Trachyphloeides*, some of which are winged.

Lichenophagus.—Allied to *Cænopsis* and *Omius*, some of which are winged.

Xenorhaches.—Allied to *Choragus*, winged.

Ellipsodes.—Closely allied to *Crypticus*, some of which are winged.

Hadrus.—Belongs to an apterous group of *Opatrides*, many of which are winged.

Macrostethus.—Belongs to *Cœlometopides*, all of which are apterous, but comes next to the *Tenebrionides vrais*, of *Iacordaire*, which are mostly winged.

Xenomoma.—Belongs to the *Aleocharides*, which are winged.

Mecognathus.—Allied to *Sunius*, winged.

Metopsia.—Allied to *Phlaobium*, winged.

Here we have indications of an introduction of forms at a still more remote epoch. In many cases the modifications of structure have been so great as to produce distinct generic forms, while these remain still allied to winged European genera. In other cases, however, the modifications are still greater, and the affinities are with groups which in Europe are wholly apterous. Such cases as *Hadrus* and *Macrostethus*, which belong to small groups of wholly apterous genera, are difficulties on the theory of transmission over the sea. But two considerations render this difficulty less real than apparent. They all carry us back to a very remote epoch; and, knowing what we do of the instability of the apterous condition, we may fairly conclude that the groups in question were, at that time, in a partially winged state. At or near this same remote epoch, the Madeiran group, as indicated by the submarine bank now connecting the several islands, probably formed one more extensive island, and the distance of ocean to be traversed would then have been considerably less than it is now.

If the various groups of facts which I have here set forth, respecting the distribution of apterous and winged species and genera, are fairly considered as a whole, I think they will be seen to be quite inconsistent with the theory of that distribution having been effected by a former land connection with Europe; and, considering that we are necessarily ignorant of many of the ways by which organisms are transmitted across ocean barriers, such transmission seems to be indicated in the case of the Madeiran Coleoptera, not by means of drift wood and ocean currents, which Mr. Murray thinks must be the most efficient means of transport, but by some mode in which their wings are called into play, which can only be by a passage through the air when assisted by gales and hurricanes.

There is one other group of islands which seems well adapted to offer a crucial test of the correctness of the theory of land-connection. The Azores are more than twice as far from Europe as the Madeiras, and, what is of still more importance, they are cut off from it as well as from the Madeiras by a broad belt of ocean of the enormous depth of nearly 15,000 feet. We may feel pretty confident, therefore, that if both groups have once been united to the continent, the separation of the Azores is by far the more ancient event; and any theory which requires the Azores to be the most recently separated must be strongly supported by independent evidence to render such an improbable supposition acceptable. If the Azores date the origin of their insect population from a remote epoch when they were connected with

Europe, we should expect to find that almost all the species have since become modified, and that these islands would offer us a larger proportion of highly specialised and ultra-indigenous forms than Madeira itself. The exact contrary, however, is the fact, for, out of more than 200 species only about sixteen are peculiar.

Taking the geodephagous group, the species of which, both Mr. Murray and Mr. Wollaston believe, are least liable to be introduced by man, we find that two only are peculiar, while sixteen are European. The Rhynchophora only equal the Geodephaga in number of species, and seven of these are peculiar. Leaving out a large number of species which have, there is little doubt, been introduced through human agency, there remain more than 100 species identical with those of Europe and the Atlantic islands, while only fourteen are peculiar. These facts imply that the insects, as a whole, have been brought to the islands through natural causes, and that the process is probably still going on. On looking to Physical Maps for information, however, a difficulty appears; for the ocean currents, as well as the prevalent regular winds, are all from the westward, while only four of the beetles are American, and these being all wood-borers, have no doubt been brought by the Gulf Stream where they have not been introduced by man. Fortunately, however, we have a means of getting over this difficulty; for our member, Mr. F. Du Cane Godman, who has given us the most recent and accurate information on the natural history of these islands, informs us (in his paper on the birds of the Azores in the "Ibis" for 1866) that the stormy atmosphere, to which we have seen that Madeira owes so many of its peculiarities, is still more marked a feature of the Azores, where violent storms from all points of the compass are frequent, and annually bring to their shores numbers of European birds. As a natural result of this constant influx, the birds of the islands are, all but two, of European species; and, what is very important, they decrease in numbers from the eastern to the western islands of the group. This is just what we should expect if they are stragglers from the eastern continent; but if they are the descendants of those which inhabited the country before its dismemberment, there would be no meaning in such a diminution. Now we can hardly doubt that these same storms also bring Coleoptera and other insects to the Azores, though it may be more rarely and in smaller numbers than in the case of the birds; and the large proportion of European species will then be very intelligible. The same explanation is suggested by the proportions of the most important groups, for while (after deducting all those species believed to have been introduced by man) the Geodephaga and Brachelytra are by far the most numerous, the Rhynchophora and the Heteromera are exceedingly few, a distribution which corresponds with their respective powers of flight. It is also a very important fact that only four non-introduced species can be traced to an American origin, while more than a hundred are European; since it shows of how little importance are ocean currents as a means of conveying insects over a wide extent of sea; whereas the great mass of the non-introduced species have evidently passed through the air, aided by their powers of flight, for a distance of about a thousand miles from Europe. The Azorean Elateridae form a curious feature of its fauna, considering that the whole family is almost absent from Madeira and the Canaries. Of the six species two are European (one specially Portuguese), so that they may have been introduced with living plants. Two are common South American species, probably introduced in the floating timber, though they may also have come with living plants, which are often brought from Bahia. Two species, however, are peculiar, and one is closely allied to a Brazilian species, so that it must have been introduced by natural agencies before the settlement of the island; the other is of a genus confined to Madagascar.

Now it is a suggestive fact that the Mozambique current, bending round the Cape of Good Hope to the Equator, is one of the sources of the Gulf Stream; so that it is not impossible that a tree, carried down by a flooded river on the west coast of Madagascar, might ultimately reach the Azores. That it should convey living larvæ or pupæ of Elaters may also not be impossible; and if such a log reached the Azores but once in ten thousand years, and but one log in a thousand should convey living Elaters, we should still, if the calculations of geologists have any approximate value whatever, be far within the epoch of existing genera, and even of most existing species. A relation so isolated and extraordinary as that between a single insect of the Azores and those of Madagascar, may well be due to a concurrence of events as rare and improbable as this seems to be.

The Azores, and in a less degree the Madeiras, appear to me to teach us this important lesson in the laws of distribution of birds and insects—that it has been determined neither by the direction of ocean currents nor by that of the most prevalent winds, but almost wholly by such more exceptional causes as storms and hurricanes, which still continue to bring immigrants from the nearest lands.

SOCIETIES AND ACADEMIES

LONDON

Zoological Society, March 21.—Mr. R. Hudson, F.R.S., in the chair. The Secretary read a report on the additions to the Society's Menagerie during the month of February, 1871.—Mr. Sclater exhibited a skin of the Ceylonese *Prima*, recently spoken of by Mr. W. Vincent Legge in a communication to the Society, and now forwarded by that gentleman, which appeared to be identical with *P. socialis* of continental India.—An eleventh letter was read from Mr. W. H. Hudson, on the ornithology of Buenos Ayres.—Dr. Hamilton communicated an extract from a letter received from China relating to the reproduction of a Chinese Deer, *Hydropotes inermis*.—Mr. Sclater read a paper on the Birds of Santa Lucia, West Indies, containing an account of a collection recently made in that island by the Rev. Mr. Semper, and forwarded to Mr. Sclater by Mr. G. W. des Vœux. Amongst these specimens were two examples of an *Icterus*, believed to be undescribed and proposed to be called *I. laudabilis*.—Dr. R. O. Cunningham read a paper on some points in the anatomy of the "Steamer Duck," *Micropterus cinereus*, based upon specimens of this bird obtained by him during his recent voyage as Naturalist to the Survey of the Straits of Magellan. A communication was read from Mr. R. Swinhoe, containing a revised catalogue of the Birds of China and its islands. To this were added descriptions of new species, together with references to former notes and occasional remarks.

Chemical Society, March 16.—Prof. Williamson, F.R.S., president, in the chair. Mr. C. H. Piesse was elected a fellow. Mr. C. H. Gill read a note "On the examination of Glucose containing Sugars." It is known that coloured sugar solutions are decolourised and clarified by the addition of basic lead acetate before they are submitted to optical examination. Mr. Gill now found that the power of invert sugar to rotate a ray of polarised light is greatly altered by the presence of that reagent. The alteration takes place only on the levulose in the liquid, the dextrose suffers no change of optical properties. This alteration is not permanent—on removing the lead or acidifying the liquid the original rotatory power is restored. Mr. Gill employs these latter reactions in order to obtain correct numbers with the saccharometer. He uses a strong solution of sulphuric dioxide, which removes the lead, and at the same time bleaches the liquid, but is incapable of inverting cane sugar in the cold even in twenty-four hours. The presence of the lead salt in sugar solutions is also disadvantageous when the glucose has to be estimated by Fehling's copper solution, as it partly becomes reduced, and thus necessitates the use of a greater volume of the saccharine solution; the removal of the lead does away with this source of error.—Mr. D. Howard made some remarks on the boiling point of a mixture of amyl alcohol and water.—Mr. Perkin stated that he had succeeded in obtaining bromacetic acid by gradual addition of bromine to heated acetic anhydride, boiling for some time, mixing with water and subsequent distillation.—Mr. Warrington spoke briefly of an easy and sufficiently correct determination of ammoniac sulphocyanide in commercial sulphate of ammonia.

Entomological Society, March 20.—Mr. A. R. Wallace, president, in the chair. Prof. P. M. Duncan, F.R.S., and Mr. E. S. Charlton were elected members. The Rev. L. Jenyns, in a letter to Mr. Dunning, made some remarks on the statement of Mr. Bond, at the last November meeting, respecting the swarming of *Chlorops lineata* in the Provost's Lodge at King's College, Cambridge. Mr. Jenyns had a similar swarm in 1831, and occurring probably in the same room.—Mr. Verral exhibited a fly, *Pipiza noctiluca*, from Perthshire, to the head of which a substance was adhering, probably the pollen-mass of an orchid.—Mr. Müller exhibited a gall, in shape like a grain of wheat, on the leaves of a *Carex*, sent to him by Lord Walsingham from Thetford.—Mr. C. O. Waterhouse read a description of *Apterocyclus honoluluensis*, a new genus and species of Lucanidae from